

REMARKS/ARGUMENTS

Claims 1-3 and 5-9 are pending herein. The PTO has withdrawn claims 5-7 from further consideration. New claim 9 has been added as supported by paragraph [0023] in the specification, for example. Applicants respectfully submit that no new matter has been added.

Examiner Turocy and Supervisory Examiner Meeks are thanked for courtesies extended to Applicants' representatives during a telephonic interview on July 9, 2008. The substance of that interview has been incorporated into the following remarks.

Claims 1-3 were rejected under §103(a) over Yara in view of Hartmann and Awazu, and claims 1-4 and 8 were rejected under §103(a) over Yara in view of Mizuno. These rejections are respectfully traversed.

Claim 1 recites a method of producing a thin film using opposing electrodes, the method including a step of applying a pulse voltage on the opposing electrodes under a pressure of 100 to 1600 Torr in an atmosphere comprising gaseous raw material including a carbon source, to generate a discharge plasma to form a thin film of diamond like carbon on a substrate. The pulse voltage has a pulse duration of less than 1000 nanoseconds and the diamond like carbon thin film has a Raman spectrum comprising a mean peak at about a wave number of 1580 cm^{-1} and a shoulder peak in a wave number range of 1300 cm^{-1} to 1500 cm^{-1} .

Yara discloses a method for producing thin carbon films at low temperature by setting a solid dielectric along an opposing plane of counter electrodes and creating a plasma by applying a pulse electric field between the counter electrodes in an atmosphere containing carbon and oxygen and/or hydrogen under a pressure near atmospheric pressure. The PTO relies upon Hartmann and Awazu for disclosing

diamond-like carbon thin films having a Raman spectrum allegedly near the claimed wave number values. The PTO relies upon Mizuno for allegedly disclosing an ultrashort pulse discharge plasma for forming DLC thin films under low or vacuum pressure conditions.

Claim 1 is distinguishable from the cited references for at least the following reasons.

First, the diamond like carbon (DLC) thin film produced by the present invention has a Raman spectrum that is distinctly different from the DLC thin film produced by Yara. More specifically, the DLC thin film produced by Yara has a Raman spectrum mean peak at about 1332 cm^{-1} (Yara, paragraph [0049]). In contrast, the DLC thin film of claim 1 has a Raman spectrum including a mean peak at about 1580 cm^{-1} and a shoulder peak in the range of 1300 cm^{-1} to 1500 cm^{-1} . The mean peak of 1580 cm^{-1} (G-band) is characteristic of a diamond like carbon structure of good quality. The peak value of 1332 cm^{-1} disclosed by Yara is identified as crystalline diamond (see Yara, paragraphs [0049] and [0052]-[0054]).

Hartmann and Awazu fail to overcome the deficiencies of Yara because the peak set 1475 cm^{-1} and 1548 cm^{-1} of Hartmann are caused by amorphous carbon structure impurities in the diamond like carbon and the peaks at 1590 cm^{-1} and 1500 cm^{-1} of Awazu are caused by crystalline graphite impurities and linear carbon to carbon bonds without hydrogen impurities, respectively. In contrast, the claimed mean peak and shoulder peak values are physical characteristics of diamond like carbon of good quality and are not due to impurities in the diamond like carbon structure. Therefore, the claimed diamond like carbon is physically distinct from the DLC of the asserted references.

During the interview, Examiner Turocy and Supervisory Examiner Meeks queried how the mean peak values of the DLC of claim 1 were so distinctly different from the DLC formed by Yara based on Yara disclosing the use of pulse durations of 1 ms or greater (1000 nanoseconds). In response, the inventors of the present invention respectfully assert that while Yara indicates that pulse durations of 1 ms (1000 nanoseconds) or greater could be used, one of skill in the art, after reading the Yara disclosure in its entirety, would conclude that Yara's actual data was limited to pulse durations of 20 ns (i.e., 20,000 ns) (see Yara examples starting at paragraph [0051]) and that the considerably broader, disclosed pulse duration lower limit of Yara was merely speculative, as evidenced by Yara's actual test data using a pulse duration of 20 ns.

Second, Yara specifically teaches away from using pulse durations of less than 1 ms (1000 nanoseconds) because the plasma discharge would be unstable according to Yara. Mizuno fails to overcome the deficiencies of Yara because the method disclosed by Mizuno requires a vacuum chamber to provide a low pressure or vacuum environment to form the DLC thin film using pulse durations of less than 1 ms (1000 nanoseconds). In accordance with MPEP §2144.05, Yara's express disclosure of pulse durations of less than 1 ms are unstable, which expressly teaches away from the claimed pulse duration and, by itself, should be sufficient to rebut the PTO's asserted *prima facie* case of obviousness.

During the interview, Examiner Turocy and Supervisory Examiner Meeks also questioned why the present invention appears to contradict Yara's express disclosure that plasma generated using pulse durations of less than 1 ms (1000 nanoseconds) is unstable under near atmospheric pressures. In response, the inventors of the present invention respectfully submit that this apparent contradiction further supports the

conclusion that the pulse duration lower limit disclosed by Yara was mere speculation, again as evidenced by the actual test data of Yara using pulse durations of 20 ms. This conclusion is further supported by the testing performed by the present inventors contrary to the teachings of Yara which clearly demonstrates that pulse durations of less than 1000 nanoseconds can be used to form a plasma and produce diamond like carbon of high quality having different physical characteristics than the DLC formed by Yara, as discussed above.

In response to the PTO's assertion that the present invention was obvious because the cited references disclose the same technique for forming diamond like carbon thin film (Office Action, page 6), Applicants respectfully submit that the present invention of claim 1 is based on actual test data which actually contradicts the express, yet clearly speculative disclosure of Yara concerning the lower limit of pulse durations that can be used to form diamond like carbon thin film.

Third, one of skill in the art would have had no reason to combine the references as asserted by the PTO because persons of skill in the art would not combine a pulse duration used to generate a plasma under low pressure or vacuum pressure (as in Mizuno) with a process for forming diamond like carbon under near atmospheric pressure (as in Yara), because pulse durations used to generate a plasma in a low pressure or vacuum atmosphere are specific to that environment and cannot be assumed to work in a process under atmospheric pressure. Further, other than the disclosure in the present application itself, the PTO has failed to provide any technical support for assuming that the pulse durations disclosed by Mizuno would be effective under near atmospheric pressure as in Yara. Therefore, absent Applicants own disclosure, one of skill in the art would have had no motivation to combine the pulse durations disclosed by Mizuno under near vacuum conditions with the method of Yara

for forming diamond like carbon under near atmospheric condition as asserted by the PTO.

Since the teachings of the prior art can only be combined if there is some reason to do so, Applicants respectfully submit that this rejection is based on hindsight reconstruction and the PTO has failed to establish a *prima facie* case of obviousness. Here, the PTO ignores the disclosure of Yara expressly teaching away from using pulse durations of less than 1 ms, and that the pulse durations of Mizuno were only used in a low pressure or vacuum environment, not under near atmospheric pressures as claimed.

Based on the above, the cited references fail to teach or suggest each and every element of claim 1. Accordingly, Applicants respectfully request that the Examiner reconsider and withdraw this rejection.

For at least the foregoing reasons, Applicants respectfully submit that all pending claims herein are in condition for allowance. Accordingly, Examiner Turocy is requested to issue a Notice of Allowance for this application in due course.

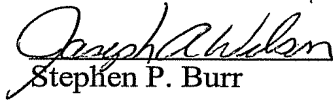
If Examiner Turocy believes that further contact with Applicants' attorney would be advantageous toward the disposition of this case, he is herein requested to call Applicants' attorney at the phone number noted below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1446.

Respectfully submitted,

August 4, 2008

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